SUPPLEMENT.

MR. NAPIER'S TRACING INSTRUMENT.

A DESCRIPTION and figure of Mr. Napier's Tracing Instrument are inserted in the 37th Vol. of the Society's Transactions, p. 63. On examining the description there given, some inaccuracies have been detected, the correction of which, in the opinion of the Committee, would be more satisfactorily made, by re-publishing the description so amended, than by a mere list of *corrigenda*.

[The reader is requested to correct a trifling error in the engraving of the instrument: the screw under fig. 10 is by mistake called *h*, instead of *p*, to which it may be easily altered with a pen; it will then agree with the other parts of the engraving, and with the references in the description.]

This instrument, which is intended for making copies of drawings, or prints, either direct, or in reverse, is described [see Plate 5, Vol. 37] in a plan, fig. 1, and an edge view, fig. 2, remarking, that in the former, it is prepared for making a direct, and in the latter, for a reverse tracing of the drawing, or print. It consists of a flat board, or frame B C D E, fig. 1, divided by a cross-bar X, into two portions, one of them, A, to receive the original, and the other, F, to contain the paper

for the copy. When, however, the tracing is to be the reverse of the original, the paper is fixed by the sliding springs M M, to the underside of the frame H I K L, fig. 1, or H I, fig. 2, which falls turning on the joints at B and E, immediately over the portion F, of the larger frame; the end I K, supported by two screw-pins *i i*, to which, by means of nuts, may be given any requisite degree of elevation; the joints on which the frame H I K L turns, may also be depressed, or elevated by similar screws and nuts *i i i* (see the extremity H, fig. 2); at H and I are seen two of the nuts and screws, which bind the ends of the springs M M, to the frame H I, which latter, when not in use, falls back at a small angle from the perpendicular, and is therefore drawn foreshortened at H I K L, fig. 1.

The tracing instrument consists of two long arms N N, O O, and four shorter, P, Q, R, S, forming together the two parallelograms N O R S, and N O P Q, the parts comprised in the latter, divided by equidistant holes, to admit the alteration of its points of motion, and consequently to vary at pleasure the proportions between the original and the tracing. Near the intersection of the arms R S is fixed the handle *g*, by which the blunt-pointed pin *d* (shown also at *d h*, figs. 2 and 5) is guided over the lines of the drawing, or print. The pin *d* is not however fixed to the arms R S, or to the handle, but moves freely up and down in a tube placed at the junction of the limbs of the parallelogram, and forming the axis round which they move; this tube is described in section at fig. 5, together with the piece projecting from its lower extremity, to which is applied, by a universal joint, the handle *g*. The pin is limited in its motion downwards, by its head *e*, and upwards by the small cross pin *h*, and it is kept down to the paper by the spring *f*, attached to the limb R.

This spring, with a gentle and equable pressure, preserves

the point in contact with the original drawing, notwithstanding the various degrees of elevation which are occasionally required to be given to the limbs of the parallelograms, either for maintaining the action, or the marking-pen or pencil *c*, or for overcoming any irregularities in the surface of the paper. The use of the spring will appear more evident, from considering, that in using the instrument, as in fig. 1, for direct tracing, the hand of the artist must communicate to the hither parallelogram a tendency to rise, in order that the marker at the opposite extremity may be kept applied to the paper; but while in use for reverse tracing, as in fig. 2, a contrary tendency must be produced; and it is plain, that without the intervention of the spring, the point *d* could not, under both circumstances, be maintained in contact with the original. When it is required to pass from one part of the paper to another without marking, the handle need merely be acted on in a contrary direction, and the marker is immediately relieved. The pen or pencil is placed in a tube *c*, similar to that containing the pin *d*.

The joint placed beneath the intersection of, and supporting the two parallelograms, is constructed so as to allow the greatest facility of motion in all directions; it is shown in a plan, fig. 3, and a section, fig. 4, and its constituent parts are detailed in figs. 9, 10, 11, 12, and 13. The pieces figs. 9 and 13, stand at right angles to each other, and on opposite sides of the ring, fig. 12; and the return ends at *l m u v* being perforated, are applied by the screws T U V W to the ends of the radial arms *q*, *r*, *s*, *t*, fig. 12, the latter having concavities to receive the conical points of the screws, and thus forming altogether a universal joint; *n*, in figs. 4 and 10, is a spring, of which there are two, standing also at right angles to each other, the middle of the convex side of each spring, bearing against the centres of the pieces *l m* and *u v*,

figs. 9 and 13, respectively, while the extremities of the springs play against the four cylindrical arms *q r s t*, radiating from the ring, fig. 12; these springs, by keeping the parts of the joint in a state of tension, prevent any shake in the centres of motion, and cause the instrument, when unbiassed by an extraneous force, to assume a horizontal position. In fig. 14, X is the cross bar of the main frame of the instrument; Y and Z are the nut and screw, by which the lower portion of the joint (the piece fig. 13) is clamped to it. N N and O O, fig. 8, are an edge view and plan of the central portion of the limbs, bearing the same letters in fig. 1, and to these are secured by the screws *k* and *p*, both received into one nut the piece fig. 9, which forms the upper portion of the joint; *w*, in fig. 4, is the section of the piece fig. 13; and immediately between the shoulder of the screw *p* and the piece *l m* is seen the section of the uppermost spring, nearly cut through, by the perforation for the screw *p*.

Figs. 6 and 7 represent the two moveable joints at *a b*, *a b*, fig. 1, which permit the alteration of the size of the parallelogram, N O P Q, together with the screws, which passing through the holes in the limbs, retain them in their places but allow perfect freedom of motion round them as centres.

MR. HARDY'S TIME-KEEPER.

In the last Volume will be found a very detailed account of the Escapement, Train, and Pendulum of Mr. Hardy's Time-keeper, for which the large Gold Medal and Fifty Guineas were voted to him in the Session 1819-20. The subjoined account of the rate of going of two of Mr. Hardy's Clocks, one at the Royal Observatory Greenwich, the other at the Royal Military College, Sandhurst, will no doubt be both interesting and satisfactory.

Royal Observatory.

1820			1820		
Apr.	22, 25	1.4 —	Aug.	26	1.4 —
	29	0.9 —		28	1.4 —
May	4	1.1 —	Sept.	2	0.9 —
	9	1.1 —		7	1.2 —
	12	1.0 —		12	1.3 —
	15	1.0 —		18	1.3 —
	19	0.9 —		29	1.0 —
	23	1.3 —	Oct.	3	1.0 —
	27	0.9 —		6	0.7 —
June	12	0.9 —		12	1.1 —
	25	0.9 —		17	0.8 —
	27	0.9 —		24	0.7 —
July	1	1.3 —		28	0.7 —
	6	1.2 —		30	0.7 —
	11	1.0 —	Nov.	2	0.9 —
	17	0.9 —		14	0.9 —
	24	1.1 —		17	0.8 —
	30	1.2 —	Dec.	7	0.9 —
Aug.	4	1.1 —		28	0.8 —
	8	1.4 —	1821		
	13	1.3 —	Jan.	29	0.5 —
	18	1.1 —	Mar.	15	0.5 —
	22	0.9 —	Apr.	9	0.6 —

Royal Military College, Sandhurst.

1820			1820.		
Feb.	17	0.″6 +	June	23	0.″
	28	0.8 +	July	10	0.1 —
Mar.	1	1.0 +		17	0.2 —
	5	1.1 +		23	0.
	8	0.9 +		27	0.2 —
	15	0.6 +	Aug.	1	0.1 +
	30	0.5 +		10	0.2 +
April	5	0.4 +	Sept.	1	0.3 +
	11	0.6 +		21	0.7 +
	20	0.3 +	Oct.	3	0.7 +
	28	0.		17	0.8 +
May	5	0.2 +		26	1.1 +
	11	0.1 +	Nov.	1	0.9 +
	21	0.1 +		4	1.1 +
	29	0.2 +		16	0.9 +
June	7	0.1 +		23	0.8 +
	12	0.2 +	Dec.	13	1.0 +
	15	0.2 +			

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